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Vol. 51 No. 4

BULLETIN
OF THE
TORREY BOTANICAL CLUB

APRIL, 1924

The Tissue Fluids of *Cuscuta**

J. Arthur Harris

I. INTRODUCTION

The relationship of the phanerogamic parasite to its host presents a group of problems of great biological interest and economic importance. Physiologically, one of the most interesting of these groups of problems is that of the relative magnitude of various physico-chemical constants in the parasite and host form, since it is upon these forces that the absorption of water and essential solutes may be reasonably assumed to depend.

Earlier studies on the mistletoes have indicated that in general the osmotic concentration of the tissue fluids of the parasites is higher than that of the host plant. This has been shown for *Viscum* by plasmolytic studies by Senn (8).† It has been found to be the case in Jamaican Montane Rain Forest (4) and in desert Loranthaceae (1). The osmotic concentration of a secondary loranthaceous parasite has been found to be higher than that of the primary parasite (2), (4). Furthermore there is evidence that the specific electrical conductivity, K, of the tissue fluids of desert mistletoes is higher than that of the host plant (5). Finally, it is interesting to note that in these parasites, as in terrestrial vegetation, the osmotic concentration is far higher in the desert forms than in those of the rain forest.

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* The determinations reported here were made in part in connection with field operations for the Office of Alkali and Drought Resistant Plant Investigations and the Office of Biophysical Investigations of the Bureau of Plant Industry, U. S. Department of Agriculture.

† Numbers refer to literature cited.

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While some of these Loranthaceae are leafless species, all are chlorophyll-bearing. The investigation of a form less capable of photosynthesis seems desirable.

III. PRESENTATION OF DATA

As far as I am aware determinations on *Cuscuta* have not been published heretofore. The purpose of the present note is to call attention to a few readings made on plants growing under a rather wide range of environmental conditions.*

A single set of determinations† of osmotic concentration in atmospheres, P, as computed from the freezing point depression, Δ, made in August, 1914, on *Cuscuta* sp. growing on *Impatiens biflora* Walt. in saturated soil at Cold Spring Harbor, Long Island, gave for the stem and leaves of the host and for the stems of the parasite:

Sample Number	Freezing point depression, Δ	Osmotic concentration in atmospheres, P
Stems of *Impatiens*, C14431 A	0.41	4.88
Leaves of *Impatiens*, C14431 B	0.46	5.55
Stems of *Cuscuta*, C14431 C	0.45	5.36

The host and parasite do not seem to differ significantly in osmotic concentration.

A single determination was made on *Cuscuta* sp. growing on *Chrysoma laricifolia* (A. Gray) Greene at the mouth of Pima Canyon, Santa Catalina Mountains, Arizona, April 3, 1914. The host tissue was accidentally lost. The parasite gave:

Sample Number	Freezing point depression, Δ	Osmotic concentration in atmospheres, P
C14131 *B*	0.74	8.90

The osmotic concentration of the desert *Cuscuta* is higher than that growing in the hydrophytic habitat.

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* This fragment is published because of the fact that the writer has been unable, notwithstanding persistent effort during the past several years, to secure sufficient materials for further determinations.

† All determinations of physico-chemical constants of the expressed tissue fluids have been determined by a technique employed during the past several years in a number of investigations. Methods and results have been recently reviewed elsewhere (3).

In 1920 while working in cooperation with R. A. Gortner, W. F. Hoffman and A. T. Valentine in Tooele Valley, Utah, the writer found *Cuscuta salina* Engelm. on the extremely halophytic *Allenrolfea occidentalis* (S. Wats.) Kuntze. The determinations in the accompanying table were made on tissues of the parasite collected from many host plants and on the samples of tissue of the individual host plants upon which the parasites were growing. The results appear in the accompanying table.

Number and Species	Freezing point depression Δ	Osmotic pressure in atmospheres P	Specific electrical conductivity K	Ratio of conductivity to depression K/Δ	Chloride content per liter Cl
C 20723					
Cuscuta	2.25	27.0	.0205	.0091	5.3
Allenrolfea	3.70	44.4	.0700	.0186	21.8
Difference	—1.45	—17.4	—.0495	—.0095	—16.5
C 20727					
Cuscuta	2.16	26.0	.0183	.0085	3.8
Allenrolfea	3.56	42.6	.0690	.0194	19.1
Difference	—1.40	—16.6	—.0507	—.0109	—15.3
C 20729					
Cuscuta	2.07	24.8	.0203	.0098	4.5
Allenrolfea	3.21	38.5	.0652	.0203	17.2
Difference	—1.14	—13.7	—.0449	—.0105	—12.7

In each of the three pairs of determinations the osmotic concentration as measured in terms of freezing point depression, Δ, and atmospheres osmotic concentration, P, is lower in the parasite than in the host. The same is true of the specific electrical conductivity, K, and of the ratio of specific electrical conductivity to freezing point depression, K/Δ. Thus the concentration of total solutes and of solutes capable of carrying the electric current is lower in the parasite than in the host plant.

The determinations on chloride content made by Mr. Lawrence by a method described elsewhere (7) are particularly interesting. The results are given in terms of grams of Cl per liter of tissue fluid. The tissue fluids of *Cuscuta* contain only about one-fourth of the chlorides found in the host plant.

The explanation of these results, which are conspicuously different from those elsewhere announced for the Loranthaceae, and from others which are still unpublished for root parasites, is not clear. It must be the object of further investigation. Possibly the hydration of colloids plays a part in the phenomenon. Possibly the *Cuscuta* is highly ephemeral in its development and grows only at a time when water lost from the host to the parasite can be readily replaced by the host plant from the soil.

In this connection it is interesting to note that the *Allenrolfea* upon which these plants of *Cuscuta* were found grew in a locality where a number of other plant species occurred, and not under the most saline conditions of the areas along the southern shore of the Great Salt Lake (3). (6).

SUMMARY

Determinations on *Cuscuta* indicate that the desert forms have a far higher osmotic concentration of their leaf tissue fluids than those of moist regions. This result is in accordance with the findings so far published for the osmotic concentration of the mistletoes.

When parasitic on an extreme halophyte, *Allenrolfea occidentalis*, the dodder, *Cuscuta salina*, shows high values of osmotic concentration, specific electrical conductivity and chloride content, but these are in every instance lower than those demonstrated in the tissue fluids of the host plant. This result is contrary to that generally found for the Loranthaceae.

Dynamic phases of these interrelationships are open to investigation.

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Chinese Marine Algae

MARSHALL A. HOWE

(WITH PLATES 1 AND 2)

In November, 1919, the late Mr. F. S. Collins published in Rhodora (**21**: 203–207) a short paper on "Chinese Marine Algae," based chiefly on a small collection made by Mrs. Spencer Lewis in 1915 at Pei-tai-ho, in the Gulf of Pe-chi-li. In this Lewis collection Mr. Collins named 27 species and referred three others to genus only. Of the 27 species, 17 are said to be reported for the first time as occurring in China. From the previous rather meager literature on the Chinese marine algae, Mr. Collins accepted 18 species as satisfactorily determined, making the very modest grand total of 45 species of marine algae known from the Chinese coasts. However, specific determinations in the important genus *Sargassum* were not included, as the author considered determinations in that genus more difficult and uncertain than in the other genera. And under the heading "Species recorded from China but unverified and improbable," Mr. Collins listed 11 species reported by von Martens in 1866, nine species (excluding one duplicated by v. Martens) reported by Debeaux in 1875, and one species reported by Mrs. Gepp in 1904.

In compiling and combining the previous lists of Chinese algae Mr. Collins overlooked the longest list of all, the one published by Mr. A. D. Cotton in 1915.* This list included 39 species and is based chiefly on specimens collected at Wei-hai-wei, with addition of a few from Hong Kong, Macao, and Formosa, the last-named being Chinese geographically, even though Japanese politically. Cotton's list includes 11 species of *Sargassum*, a genus omitted by Collins on account of its difficult nature, but in naming the species of *Sargassum* Cotton had the assistance of Yendo, who had given much attention to this genus in Japan, and it seems probable that at least 10 of these species are as deserving of recognition as are any of the other species that have been attributed to Chinese waters. But *Ecklonia cava* Kjellm., found in the markets of

* Some Chinese Marine Algae. Kew Bull. Misc. Inf. **1915**: 107–113. 1915.

Peking, may well have been imported from Japan, as was recognized by Cotton, and should probably be excluded.

A shorter list of Chinese seaweeds, published only a few months before Collins' paper, was contributed by Major Th. Reinbold to Loesener's Prodromus Tsingtauensis.* Excluding one doubtful determination, referred to below under *Polysiphonia japonica*, this list includes 9 species, of which 4 appear to be additions to lists published before that date. Including these 4 species, 10 of the 11 species of *Sargassum* reported by Cotton, and the other species of Cotton's enumeration that are not recognized in Collins' approved list, and allowing for one duplication in the lists of Reinbold and Collins, we seem justified in stating that the number of Chinese algae known on the publication of Collins' paper may conservatively be placed at 80.

The small collections reported upon below were made by Mr. N. H. Cowdry, partly in the summer of 1919 in the vicinity of Pei-tai-ho, the locality from which came also the specimens studied by Mr. Collins, and partly in the summer of 1920 at Chefoo. The specimens from Pei-tai-ho were forwarded for determination by Dr. Wm. R. Maxon, Associate Curator, Division of Plants of the U. S. National Museum, as was the case also with the specimens collected at the same place four years earlier by Mrs. Spencer Lewis. Later, Dr. Maxon sent a fluid-preserved specimen of *Grateloupia* that had been collected at Pei-tai-ho by Lieut. A. deC. Sowerby. Later, also, after the present writer had studied the Pei-tai-ho material submitted by Dr. Maxon, Mr. Cowdry himself brought his collection of Chinese algae to The New York Botanical Garden, most of the specimens with determinations provided by Professor K. Okamura of Tokyo, a list of whose determinations had been published by Mr. Cowdry at about the same time (Journal of the North China Branch of the Royal Asiatic Society **53**: 180, 181. 1922). The present enumeration is then but an expansion and in a small way a revision of Cowdry's previously published list. The number of species collected by Cowdry and now listed is 39, in addition to two named varieties and three species that are referred to genus only. Of the 39 named species, 12 do not appear in lists previous to Cowdry's and these 12 added to the 80 mentioned above bring the conser-

* Beih. Bot. Centralb. **37**[2]: 76. 15 Ap 1919.

vatively compiled list of known Chinese algae to 92 species, which is somewhat more than twice the known total as figured by Collins in 1919.

But even as now increased, the list is a brief one for a coast line as long and as varied as is China's and the number is sure to be greatly increased by future investigations. It seems probable, however, as already noted by Cotton, that owing to the great amount of fresh water brought down by the rivers Hoang-Ho and Yang-ste-Kiang and to other causes, the marine flora of China may prove to be not particularly rich.

Besides the two species and one variety that are here described as new, the collections made by Mr. Cowdry appear to add to lists published previously to his own the following species: *Ulva rigida*, *Enteromorpha Linza*, *Myriactis pulvinata*, *Chorda Filum*, *Sargassum microceratium*, *Dictyota divaricata*, *Neurocarpus divaricatus*, *Endocladia complanata*, *Gymnogongrus flabelliformis*, and *Gloiopeltis coliformis*.

The list is remarkable for the inclusion of a considerable number of species that appear to be identical with species that are more or less common on the Atlantic coast of the United States, such as *Ulva Lactuca*, *Enteromorpha compressa*, *E. Linza*, *E. prolifera*, *Bryopsis plumosa*, *Scytosiphon Lomentaria*, *Myriactis pulvinata*, *Leathesia difformis*, *Chorda Filum*, *Gracilaria confervoides*, *G. lacinulata*, *Champia parvula*, *Rhodomela subfusca*, *Dasya pedicellata*, *Ceramium rubrum*, and *Corallina officinalis*. This fact harmonizes well with correspondences in the land floras of eastern North America and eastern Asia already pointed out by Asa Gray and others. The annotated list follows, P referring to Pei-tai-ho and C to Chefoo:

CHLOROPHYCEAE

ULVA LACTUCA L. P, *292*. Thallus 37–45 μ thick, the cells subquadrate in section.

ULVA RIGIDA Ag. C, *525*. Thallus 60–80 μ thick, the cells twice as high as broad, showing conspicuous trigones in a surface view. The membrane is occasionally perforate and it is apparently the *Ulva pertusa* of Cowdry's list.

ENTEROMORPHA COMPRESSA (L.) Grev. P, *294*.

ENTEROMORPHA LINZA (L.) J. Ag. *forma*. P, *291*; C, *553*; apparently the first record for China.

ENTEROMORPHA PROLIFERA (O. F. Müll.) J. Ag. C, *526*, *527*.

CLADOPHORA sp. C, *528*.

BRYOPSIS PLUMOSA (Huds.) Ag. P, *293;* C, *531*.

CODIUM FRAGILE (Sur.) Hariot. P, *285;* C, *529*. *Codium mucronatum* of Cowdry's list. Setchell and Gardner (Univ. California Publ. **8**: 171. 1920) have recently reduced the more widely recognized *Codium mucronatum* J. Ag. to the position of a synonym of *C. fragile*, the type of which was Japanese. *Codium mucronatum* was originally described with three named forms (no specified or implied type) from Tasmania, Alaska, California, New Zealand, and Chatham Island.

PHAEOPHYCEAE

COLPOMENIA SINUOSA (Roth) Derb. & Sol. P, without number.

SCYTOSIPHON LOMENTARIA (Lyngb.) J. Ag. P, *286;* C, *550*.

MYRIACTIS PULVINATA Kütz. In cryptostomata of *Sargassum microceratium*, C, *523*.

LEATHESIA DIFFORMIS (L.) Aresch. C, *550 p.p.*, a minute form, making cushions 1 mm. broad or less, but fertile; C, *551*, making cushions 5–8 mm. broad.

CHORDARIA FIRMA Gepp. P, *288a;* C, *538*, in rock pools.

Chordaria Chordaria (Harv.) comb. nov. *Cladosiphon Chordaria* Harv. Phyc. Austral. *pl. 60*. 1858. *Chordaria Cladosiphon* Kütz. Tab. Phyc. **9**: *2. pl. 2. f. 11*. 1859. C, *536*, attached to *Chorda Filum*.

The plants are 8–12 cm. tall and are more slender and smaller in every way than in the type (from Port Phillip, Australia) figured by Harvey, who says that specimens from Georgetown, Tasmania, are "very much larger and more robust than our figure." Kützing's figure is based upon a plant from Port Fairy, Victoria, and is somewhat similar to Harvey's. Okamura has referred the present number to *Chordaria Cladosiphon* Kütz. (in herb. Cowdry) and it is apparently this that bears that name in Cowdry's Pei-tai-ho list, although the label in the Cowdry herbarium indicates that the plant really came from Chefoo. Collins also has listed the same species from Pei-tai-ho.

CHORDA FILUM (L.) Stackh. P, *284;* C, *963*. The appearance

of this name in the Cowdry list seems to be the first record for China.

CYSTOPHYLLUM THUNBERGII (Mert.) J. Ag. P, *282;* C, *521, 522.* Yendo (Jour. Coll. Sci. Tokyo **21**[12]: 118. 1909) adopts Otto Kuntze's reference of this species to *Sargassum* on the ground that the receptacles are "axillary." It seems, however, to the present writer that the receptacles are as much terminal as axillary and that the plant is rather more at home in *Cystophyllum.*

SARGASSUM CONFUSUM Ag. (?) P, *283* and another without number (May 23, 1919); C, *520 pp.*, "drifted on shore in large quantities with *Zostera.*" We have not seen Agardh's original from Japan. Our more or less doubtful determination is based chiefly on Yendo's figures and descriptions (Jour. Coll. Sci. Tokyo **21**[12]: 106–112. *pl. 14. f. 1–12.* 1909), and may be influenced by Okamura's doubtful reference of no. 520 to this species. However, no. *520* in herb. Cowdry is possibly a mixture.

A specimen from Pei-tai-ho, without number, is about 25 cm. long and shows a pronounced dimorphism or polymorphism in its leaves. Most of the leaves on certain young branches are oblanceolate or obovate, 20–35 mm. long and 6–17 mm. wide and dentate, while all of the leaves now remaining on longer older branches are narrowly linear or subfiliform, 5–45 mm. long, and subentire. The Pei-tai-ho specimen under no. *283* manifestly represents the terminal parts of a plant of the same species, with vesicles, receptacles, subfiliform leaves, and nothing at all to suggest that parts of it might bear leaves of a very different character.

SARGASSUM MICROCERATIUM (Mert.) J. Ag. C, *523, 524.* In *523*, the plants are 20–35 cm. long, the basal leaves are linear, twisted, 1–2 cm. long, 1–1.5 mm. wide, entire or nearly so; the upper leaves filiform, 2–4 mm. long, 0.2–0.3 mm. wide; the receptacles are fusiform, 2–4 mm. long; the vesicles are 1.5 mm. wide, ellipsoid or obovoid, apiculate or muticous, on pedicels that are often very short but are sometimes longer than the vesicles, sometimes showing much variation on a single plant. The part bearing the basal leaves is short, only 2 or 3 cm. long; the rest of the plant is loosely paniculate, with numerous slender branches, small vesicles, and rather

inconspicuous leaves and receptacles. In another specimen, *524*, from the same locality, the leaves and receptacles are less numerous.

The no. *523* is the *Sargassum fuliginosum* (?) of the Cowdry list. Yendo makes *S. microceratium* a synonym of *S. piluliferum* (Turn.) Ag., but Turner's original plates of the two look very different and our Chefoo plant is nearer the *S. microceratium*. *Sargassum piluliferum* has large compound dichotomous leaves; the Chefoo specimens have very small simple leaves.

DICTYOTA DIVARICATA Lamour. C, *548*, in rock pools.

DICTYOTA INDICA Sond. With the preceding and under the same number. The two species or forms apparently intergrade, as also in the West Indies. *D. indica* has been reported from Pei-tai-ho by Collins and *D. divaricata* appears in the Cowdry list, based on determinations by Okamura.

Neurocarpus divaricatus (Okam.) comb. nov. *Haliseris divaricata* Okam. Ic. Jap. Alg. 1: 57. *pl. 13, 14.* 1907. C, *549*, in rock pools. Apparently seen and named by Okamura.

RHODOPHYCEAE

GELIDIUM CORNEUM (Huds.) Lamour. In rock pools, P, *296;* C, *540, 541, 544,* and *554*. Nos. *540* and *544* are slender bitripinnate forms of this notoriously variable species, resembling Turner's varieties *pulchellum* and *claviferum;* these formed the basis of the *Gelidium Amansii* of the Cowdry list. Nos. *296* and *544* are taller, less densely and rather less regularly branched plants, somewhat resembling Lamouroux's figure of his *Fucus Amansii* (from Mauritius and Madagascar) and resembling also some of the Australian plants distributed by J. Agardh as his *Gelidium australe;* no. *554* appears to be the "*Gelidium Amansii* Lmx., f. *radicans* Okam. mscr." of the Cowdry list. No. *541* is more regularly bipinnate with more clavate, more obtuse branchlets; this is apparently the *Pterocladia capillacea* of the Cowdry list, but the specimens are sterile or tetrasporic and we find no reason for believing them to belong to *Pterocladia* rather than to *Gelidium*. A Pei-tai-ho form similar to no. *544* from Chefoo is the *Gelidium australe* of the Collins list.

ENDOCLADIA COMPLANATA Harv. C, *969 p.p.*, forming a matted covering on rocks. The thallus is only slightly complanate, but it agrees with the plant distributed under this name by Okamura in Alg. Jap. Exs. 56. In herb. Cowdry the species is mounted with fragments of *Symphycladia gracilis*, to which it may bear some superficial resemblance in size, color, and general habit.

GYMNOGONGRUS FLABELLIFORMIS Harv. C, *546* and *547*, in shaded rock pools. A narrow form, the thallus segments only about 0.6–0.8 mm. broad (when soaked out) except under the dichotomies where they may reach a width of 1.2 mm. Suringar, who, like us, had not seen Harvey's type, makes the laciniae 3 mm. broad, and Cowdry plant would seem to accord better with Suringar's *G. japonicus* (Alg. Jap. 36. *pl. 24 A*), which appears to differ from *G. flabelliformis* only in its narrower segments and generally smaller size. However, the Chefoo plant is no narrower than the Japanese plant distributed by Okamura as *G. flabelliformis* in the Algae Japonicae Exsiccatae no. 10. Possibly *G. japonicus* should be considered a synonym of *G. flabelliformis*.

GRACILARIA CONFERVOIDES (L.) Grev. P, *287* and *288b;* C, *538 p.p.* Under 287 are elongate sparingly branched tetrasporic plants 20–32 cm. long; under 538 are a few smaller more branched plants, tetrasporic and cystocarpic.

GRACILARIA LACINULATA (Vahl) M. A. Howe. P, *290*. Two or three small fragments.

CHAMPIA PARVULA (Ag.) Harv. C, *556*. Very similar to European and American forms in habit, but the superficial cells of the thallus cortex are somewhat smaller and less clearly defined and the cystocarps are often slightly larger and more globose. Mrs. Gepp has reported the species from Wei-hai-wei.

Lomentaria sinensis sp. nov. Plants small, 2–3 cm. high, flaccid, somewhat gelatinous, intertangled, dichotomous below, the main axes irregularly bipinnate, with an occasional branch in another plane, mostly 0.3–0.6 mm. in diameter, the branches and branchlets lightly constricted at base, other constrictions rare, the ultimate branchlets ovoid-fusiform to digitiform; thallus wall thin, mostly 30–65 μ thick; cells of the superficial layer mostly 12–24 μ in maximum diameter in surface view, often broader than high in cross sections of the

older parts; tetrasporangia in sori at the bottom of orbicular, oval, or elliptic pits 75–300μ wide or long, and also scattered. (PLATE 1, FIGURE 1.)

In rock pools, Chefoo, July 29, 1920, N. H. Cowdry *556, p.p.* in herb. Cowdry.

Lomentaria sinensis is allied to the type of the genus, the European *L. articulata* (Huds.) Lyngb., and to the Japanese *L. catenata* Harv., but manifestly differs from both in the smaller size of the plants, in the more bifarious branching, in the lack of a catenate or moniliform appearance owing to the rarity of constrictions except at the bases of lateral branches, and in the large superficial cells, which have 2–5 times the diameter of corresponding cells of *L. articulata* and twice the diameter of those of *L. catenata*. In general consistency, the plant is more gelatinous and less cartilaginous than *L. catenata*. The pits which form ostioles for the tetrasporic sori are more highly specialized and more obvious than in *L. articulata*, but less so than in *L. catenata*.

LAURENCIA OBTUSA (Huds.) Lamour. P, *289;* C, *539*. Referred to genus only by Okamura (in Cowdry's list) but Collins has identified similar plants from Pei-tai-ho with this widely distributed species. Tetrasporic plants under no. 539 have sporangiophores that are more corrugated and more constricted at the base than in West Indian plants that are currently referred to this species.

CHONDRIA sp. P, *299*, with incipient tetrasporangia. Near *C. tenuissima* (Good. & Woodw.) Ag.

POLYSIPHONIA JAPONICA Harv. P, *300* and a specimen without number (Sept. 4, 1919); C, *967* (on *Zostera*) and *968* (on *Chorda*); and perhaps also C, *555*, on rocks at low tide. Resembles in habit some of the West Indian plants currently referred to *P. ferulacea* Suhr, but the segments are often relatively longer, the sporangial branchlets are often more pod-like or stichidioid, the main axis is corticated at the base, and there are often traces of cortication on the principal branches in the form of narrow inconspicuous cells alternating with the primary siphons. This species is omitted in J. Agardh's "Species" and in De-Toni's "Sylloge." A plant from Wei-hai-wei has been referred to this species by Mrs. Gepp (1904), who publishes a copy of Harvey's description.

The plant from Pei-tai-ho referred by Collins to *P. ferulacea* belongs here; perhaps also the poor specimen from the Kiautschou region referred doubtfully to this species by Reinbold. In Cowdry's list the species is referred to genus only. No. *555*, on rocks, may be a form of the present species, but the plant is usually corticated almost to the apices and it has more divaricate branches; it is possibly *P. Stimpsoni* Harv.

SYMPHYOCLADIA GRACILIS (Mart.) Falkenb. P, *295;* C, *545* and *969 p.p.*

RHODOMELA SUBFUSCA (Woodw.) Ag. C, *543*, thrown up on a sandy shore. A single tetrasporic plant differing somewhat in habit from European and American plants, the difference due, perhaps, chiefly to the more curved and contorted tetrasporic branchlets. Also several loose denuded basal fragments in a bundle of "duplicates" supposed to have come from Pei-tai-ho. The species has been recorded from Chefoo by Cotton and from Wei-hai-wei by Gepp.

DASYA PEDICELLATA Ag. *Dasya elegans* (Mart.) Ag. P, *297;* C, *965*. Rather small tetrasporic plants, 9–13 cm. long. Collins was the first to ascribe this species to China, basing the record on plants from Pei-tai-ho. Okamura, in the Cowdry list, refers the specimens doubtfully to *Dasya punicea* Menegh.

CERAMIUM JAPONICUM Okam. P, May, 1919, without number; C, *557*, tetrasporic plant in rock pool, determined by Okamura.

CERAMIUM BOYDENII Gepp. P, May, 1919, without number, cystocarpic; C, *966, p.p.*, thrown up on a sandy shore, tetrasporic. Type from Wei-hai-wei. The cystocarps, which seem to be hitherto undescribed, are mostly terminal on short lateral proliferations; they are subtended and more or less enclosed by a sort of calyx of 2–8 (usually 4–6) mostly incurved bracts.

CERAMIUM RUBRUM (Huds.) Ag. P, *298* and *301;* C, *542*. Reported from Tsingtau by Reinbold.

GLOIOPELTIS COLIFORMIS Harv. C, *530*, in small clumps on rocks, often uncovered at low tide. Plants about 2 cm. high, irregularly furcate.

GRATELOUPIA FILICINA (Wulf.) Ag. C, *535* (tetr.) and *537 p.p.*

(cyst.), in shaded rock pools at low-tide mark. Like Japanese specimens currently referred to *G. filicina* (*e. g.*, Okam. Alg. Jap. Exsicc. *32*), Cowdry's plants are somewhat softer and more gelatinous and rather more inclined to be hollow than Mediterranean plants that are held to be typical of the species.

GRATELOUPIA FILICINA **porracea** (Mert.)

Grateloupia porracea (Mert.) Kütz. Phyc. Gen. 397. 1843; Tab. Phyc. **17**: *pl. 25. f. a–c.* 1867.

Grateloupia tubulosa Okam. MS. in herb. Cowdry. C, *537, p.p.*, in rock pools. This evidently intergrades with the preceding and also with the following.

GRATELOUPIA FILICINA **Lomentaria** var. nov.

Thallus terete or subterete, coriaceous or subcoriaceous, tubulose, occasionally constricted, especially in the lomentarioid ultimate branchlets, rather copiously and very irregularly branched in all directions, the cystocarpic plants sometimes vaguely bipinnate, the ultimate branchlets ovoid, ellipsoid, fusiform, or much elongated, obtuse or subacute, the tetrasporic less branched and subspinescent, the tetrasporangial branchlets commonly rostrate, mostly 0.75–1.5 mm. long. (PLATE 1, FIGURES 2–4; PLATE 2.)

East Cliff, vicinity of Pei-tai-ho, *Cowdry 302* (type, cystocarpic) Sept. 25, 1919; also at Pei-tai-ho, *A. de C. Sowerby 94* (cyst.), Aug., 1921; and at Chefoo, *Cowdry 537, p.p.* (tetr.) *538, p.p.* (cyst.) Aug. 2, 1920 and *966 p.p.* (tetr.)

The above variety differs so much in habit from the ordinary solid flattened pinnate representatives of the extremely variable *Grateloupia filicina* that its true affinities eluded the writer on the first examination. The hollow thallus, the frequently ovoid or ellipsoid branchlets very strongly constricted at the base and with occasional constrictions elsewhere suggested relationship with *Lomentaria* of the Rhodymeniaceae, from which family, however, the deeply immersed cystocarps and the more obviously filamentous cortex seemed to exclude it. The first impulse to describe the rigid Pei-tai-ho plant as a new species or even as the type of a new genus was counteracted by the discovery of its relationship to the terete or subterete hollow-thallused West Indian plant originally described as *Grateloupia porracea* (Mert.) Kütz. and now currently considered to be a form of *Grateloupia filicina*,

and furthermore by seeing later Cowdry's collections made at Chefoo, which appeared to show all gradations between the rigid mostly short-branched plant here described as *G. filicina Lomentaria* and a laxer more gelatinous longer-branched plant close to the typical *G. porracea* (*Grateloupia tubulosa* Okam. MS. in herb. Cowdry). The last-mentioned forms, on the other hand, intergrade at Chefoo with flattened pinnate forms which may be compared without violence with typical *G. filicina*.

GRATELOUPIA sp. C, *532* in herb. Cowdry. A single sterile fragment 8 cm. long, 5–10 mm. wide, subpinnate, with lanceolate lobes, which are scarcely or not at all constricted at base. Perhaps related to the Japanese *Grateloupia acuminata* Holmes. In herb. Cowdry the specimen was named *Nemastoma*.

Nemastoma Cowdryi sp. nov. Thallus lubricous, moderately gelatinous, subcorneous on drying, deep purplish vinaceous, Indian lake, or dahlia carmine, repeatedly (mostly 7–12 times) and rather regularly dichotomous, rarely trichotomous, 4–10 cm. high, the more finely divided somewhat suggestive of *Ceramium rubrum* in habit, occasionally proliferous, mostly terete or subterete, but more or less complanate in older parts and below the dichotomies, tubulose below, the wider parts 1–3 mm. broad, the widely spreading, often subdivaricate terminal branches 150–300 μ in diameter (not including the mucous sheath, which is 75–150 μ thick), the apices subacute; medullary filaments 12–24 μ in diameter; cortex consisting of 3–5 times closely di-(tri-)chotomous strictly fastigiate filaments 80–120 μ long, the penicillate clusters rather easily separable, their proximal cells ovoid, about 12–15 μ in diameter, sometimes broader than high, the succeeding cells ellipsoid or short-cylindric, 7–9 μ broad, the clusters usually terminating in rather rigid tapering unbranched filaments 2–4 cells long, their cells mostly about 3 μ broad and 2 or 3 times as long, the distal cells 12–25 μ long, commonly trichomic and often capitate; tetrasporangia scattered, sessile on cortical branchlets of the penultimate order, ellipsoid or obovoid, 30–42 μ × 16–24 μ (incl. wall), the spores decussately paired; other parts unknown. (PLATE 1, FIGURE 5.)

In shaded rock pools, Chefoo, July 14, July 29, and Aug. 2, 1920, *N. H. Cowdry 534* (type) and *533* (July 10, 1920).

Nemastoma Cowdryi is related to *N. dichotomum* J. Ag., but differs in its more delicate, more terete, more Ceramioid

thallus, and very decidedly in the longer-celled, more rigid and tapering short-piliferous filaments of the cortex.

CORALLINA OFFICINALIS L. C, *552* in herb. Cowdry.

On rocks at low tide. Reported from Pei-tai-ho by Collins.

NEW YORK BOTANICAL GARDEN

Explanation of plate 1

FIG. 1. *Lomentaria sinensis.* Photograph of the type specimen (dried). Natural size.

FIG. 2. *Grateloupia filicina Lomentaria.* Photograph of the dried type specimens (*Cowdry 302*). Natural size.

FIG. 3. *Grateloupia filicina Lomentaria.* Photograph of a formalin-preserved specimen (*Sowerby 94*, from the U. S. National Museum). Natural size.

FIG. 4. *Grateloupia filicina Lomentaria.* Photograph of a transverse section of the thallus near the base. From dried material (*Cowdry 302*), soaked out. Enlarged 84 diameters.

FIG. 5. *Nemastoma Cowdryi.* Photograph of the type specimen (dried). Natural size.

Explanation of plate 2

Grateloupia filicina Lomentaria

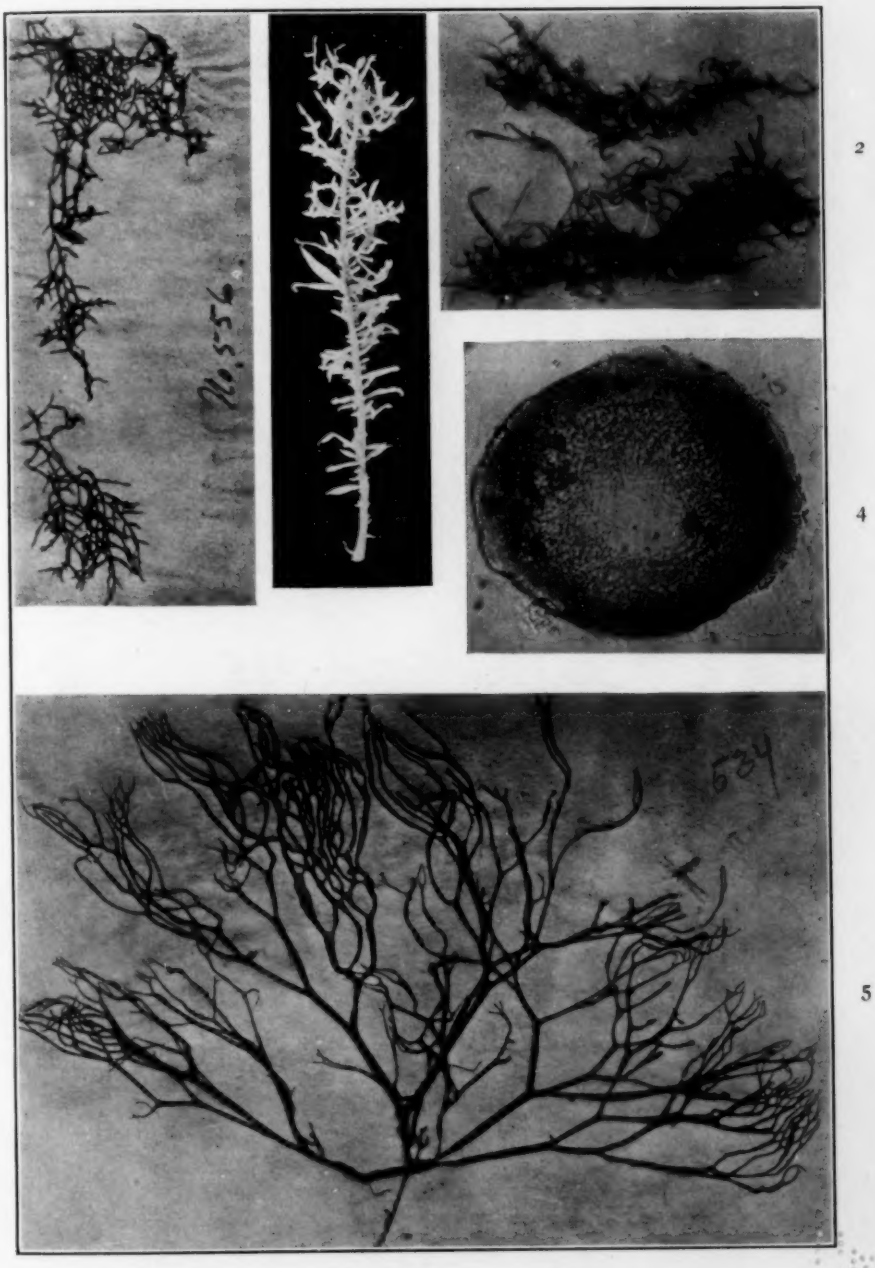
All figures are photomicrographs of microtome sections of soaked-out fragments of the dried type material (*Cowdry 302*).

FIG. 1. A transverse section through a primary or secondary axis (to the left) and median longitudinal section through the base of an ultimate branchlet, showing the tubulose character and the septum at the base of the branch. Enlarged 100 diameters.

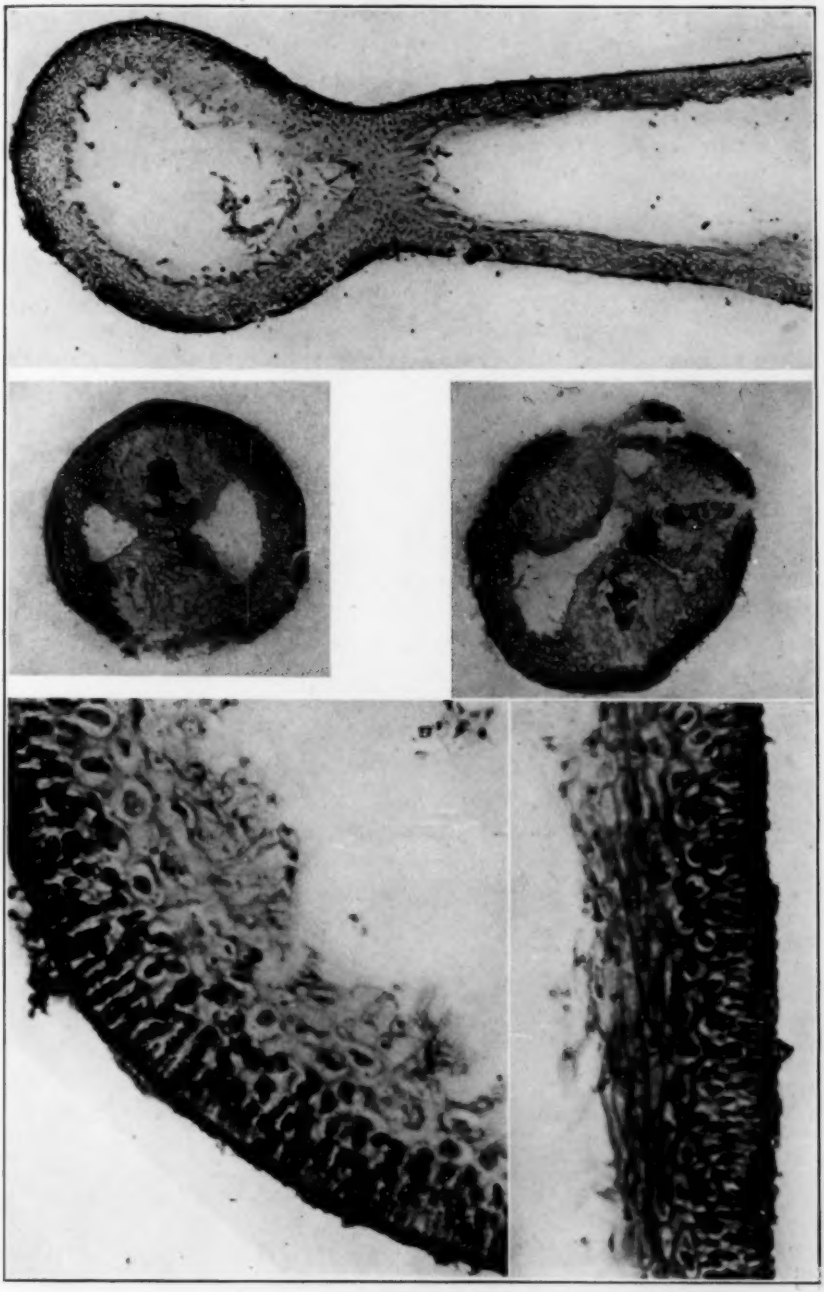
FIGS. 2 and 3. Transverse sections showing immersed cystocarps projecting into the lumen and sometimes coalescent there. Enlarged 74 diameters.

FIG. 4. Transverse section of thallus, showing cell structure, etc. Enlarged 450 diameters.

FIG. 5. Longitudinal section of thallus. Enlarged 450 diameters.



1. LOMENTARIA SINENSIS
2–4. GRATELOUPIA FILICINA LOMENTARIA
5. NEMASTOMA COWDRYI



GRATELOUPIA FILICINA LOMENTARIA

The section Tuberarium of the genus Solanum in Mexico and Central America

P. A. RYDBERG

This section belongs to the subgenus *Pachystemon* of Dunal, *i. e.*, the anthers are short, thick, subcylindric or oblong, not attenuate at the apex. It is in general characterized by odd-pinnately dissected leaves, by terminal and lateral corymbiform or racemiform cymes, plicate corollas, pedicels with an articulation, and, as the name indicates, supposedly with tuber-bearing stolons. Some botanists may have been inclined to separate it as a genus distinct from *Solanum*, and Carl Börner* united the section with *Lycopersicum* into a new genus *Solanopsis*. None of the characters by which the section is separated from the rest of the genus holds, however. *Solanum bulbocastanum* Dun., *S. muricatum* Ait., *S. apalophyllum* Dunal, *S. simplicifolium* Bitter, and *S. morelliforme* Bitter, which evidently belong to this section, have simple leaves and several species in the sections MORELLA and DULCAMARA have pinnatifid leaves. The pedicels are usually articulate some distance above the base, but in some species the articulation is practically basal. In the rest of the genus it is basal but often obsolete. The shrubby species of TUBERARIUM bear, as far as known, no tubers and in several of the herbaceous ones no tubers have as yet been found. There are therefore no constant characters to separate the section generally from the rest of the sections included in the subgenus PACHYSTEMON. Bitter† has shown that there exists still less reasons for uniting the section with *Lycopersicum*.

Since Dunal's monumental work on Solanum in De Candolle's Prodromus,‡ very little systematic work on this group has been made until in the last decade. Dunal divided the section into two groups "Potatoe," with interruptedly pinnatifid leaves, and "Pterophyllum," with regularly pinnatifid leaves. As the presence or absence of smaller intermittent lobes vary in the same

* Abh. Nat. Ver. Bremen **21**: 282. 1912.

† Rerpert. **11**: 255–260. 1912.

‡ D. C. Prod. **13**[1]: 27–43. 1852.

species, this division was very artificial. Bitter, who in 1812–15 published such valuable contributions to the knowledge of Solanum and especially of this very section, substituted instead the mode of articulation of the pedicels as the main bases of classification of this section, and established two subsections: BASARTHRUM, with basal articulation, and HYPERBASARTHRUM, with the articulation higher up. He also pointed out that the latter could be subdivided by the shape of the fruit, subconic or subglobose, and the deeper or shallower division of the corolla. Following these suggestions and elaborating on the same, I have been able to present the following key of the Mexican and Central American species as far as they are known to me.

Bitter, following more or less the German fashion of classifying the different forms of a genus in many categories, used the ranks: superspecies, or collective species, species, subspecies, variety, and forma. In most cases I have regarded his subspecies as distinct species, admitting, however, that each is most closely related to the species of which he made it a subspecies. In most cases I have not regarded it worth while to pay special attention to his varieties or formas. In one case, however, I think, a certain variety deserves specific rank, better than some of his subspecies and even better than one of his species.

Key

Pedicels articulate some distance above the base (*Hyperbasarthrum*).
  Stem herbaceous.
    Fruit globose or ellipsoid, rounded at the apex; plants with tubers.
      Leaves pinnatifid.
        Corolla 5-agonal, its lobes as broad as or broader than long..... 1. TUBEROSA.
        Corolla distinctly star-shaped, its lobes longer than broad..... 2. PINNATISECTA.
      Leaves simple; corolla star-shaped..... 3. BULBOCASTANA.
    Fruit elongated-ovoid or sub-conical, acute at the apex; plant probably not tuber-bearing.. 4. OXYCARPA.
  Stem woody, climbing; plant not tuber-bearing... 5. JUGLANDIFOLIA.
Pedicels articulate at or near the base; plant not tuber-bearing as far as known. (BASARTHRUM).
  Stem herbaceous..... 6. SUAVEOLENTIA.
  Stem woody, climbing and rooting at the nodes.. 7. APPENDICULATA.

1. TUBEROSA

Leaf-segments of an ovate type, acute or obtuse or abruptly short-acuminate.
Leaf-segments distinctly stalked, cordate or rounded at the base.
Corolla more than 15 mm. high; leaflets rather thick, densely pubescent on both sides; calyx-lobes long-acuminate ..... 1. *S. tuberosum.*
Corolla less than 15 mm. high; leaflets rather thin; calyx-lobes acute.
Leaves equally pubescent on both sides; calyx-lobes distinctly longer than broad.
Inflorescence many-flowered, usually exceeding the leaves; corolla white to sky-blue, about 20 mm. broad; leaf-segments 7–11, intermittent segments quite numerous ..... 2. *S. longipedicellatum.*
Inflorescence few-flowered, usually not exceeding the subtending leaf; leaf-segments 3–7; intermittent segments rare or none.
Corolla blue-violet; leaflets mostly 5–7 ... 3. *S. Papita.*
Corolla white, leaflets 1–3, or if 5 the lower pair small ..... 4. *S. Wightianum.*
Leaves almost glabrous above; calyx-lobes as broad as long; corolla white, 12–16 mm. broad ..... 5. *S. stoloniferum.*
Leaf-segments sub-sessile or the lower ones very short-stalked.
Plant grayish, stem and leaves densely hirsute with long white hairs ..... 6. *S. polytrichon.*
Plant green; stem and leaves rather sparingly hirsute with short hairs.
Corolla distinctly 5-angled, the sinuses without lobes ..... 7. *S. Fendleri.*
Corolla somewhat 10-angled, the interpetalar membranes produced into short lobes ..... 8. *S. demissum.*
Leaf-segments of a lanceolate type, usually long-acuminate.
Leaf-segments 7–11, decidedly pubescent, broadly lanceolate, mostly acute at the base.
Corolla 2 cm. broad or more; leaves coarsely hirsute, with intermittent segments ..... 9. *S. verrucosum.*
Corolla 1 cm. broad; leaves finely pubescent, without intermittent segments ..... 10. *S. Ervendbergii.*
Leaf-segments 11–15, narrowly lanceolate, glab-

rous or nearly so, very oblique at the base, acute on the upper margin, semi-cordate on the lower..... 11. *S. agrimonifolium.*

1. SOLANUM TUBEROSUM L. Sp. 185. 1753

The cultivated potato is apparently not wild in North America. In the United States it is found occasionally on garbage dumps and waste places, but rarely persists more than a single season. From reports, it seems to be more common in Mexico and Central America. In the United States National Herbarium there are but two Mexican specimens and in the collections of the New York Botanical Garden only one from Costa Rica. These are:

VERA CRUZ: (Orizaba) *Rose & Hay 5709.*
NUEVO LEON: *Palmer 938*, in part.*
COSTA RICA: *Kuntze 2296.*

2. SOLANUM LONGIPEDICELLATUM Bitter, Repert. 11:457. 1912

This species is closely related to *S. tuberosum*, differing in the smaller flowers, thinner leaves and acute instead of acuminate calyx-lobes. I see no reason for regarding the var. *pseudoprophyllum* Bitter, *l. c.* 458, as anything but an individual variation. Bitter himself was inclined to regard the specimen representing the type number *Pringle 8602* in the Munich herbarium as belonging to the variety, or at least approaching it. The following specimens belong here:

MEXICO (Federal District): *Pringle 8602, 8571.*
MEXICO (State): *Pringle 9142.*
GUANAJUATO: *Dugès 417 A.*

3. **Solanum Papita** Rydberg sp. nov.

A perennial, with subterranean stolons and tubers; stems herbaceous, 1–2 dm. high, terete, slender, puberulent with short acute hairs; leaves odd-pinnatifid, 4–10 cm. long; rachis slightly winged, sparingly pubescent, principal leaf-segments

* This number in the National Herbarium consists of two plants; one belongs to *S. tuberosum*, the other to *S. Fendleri*. To the latter belongs also *Palmer 937*. Maybe the specimens have been mixed.

5–7, more or less stalked, ovate, rounded or obtuse at the base, obtuse, acute, or sometimes short acuminate at the apex, 1–3 cm. long, short hirsute with few-celled hairs on both sides, dark-green above, paler beneath, the lower pairs much smaller than the rest; intermittent small segments rarely present, 1–3 mm. long; pseudo-stipular leaves lunate, 2–4 mm. long; peduncle 1–3 cm. long, puberulent; inflorescence 3–7-flowered; pedicels 1–3 cm. long, articulate above the middle, the lower portion puberulent, the upper glabrous; calyx sparingly hirsutulous, the tube 2.5 mm. long, the lobes lanceolate, acute, 2.5 mm. long; corolla dark bluish-violet, about 12 mm. broad, the lobes broadly triangular, 3 mm. long, broader than long, puberulent without; anthers oblong, cordate at each end, 3 mm. long; fruit globose, the mature berry unknown.

Type collected at Otinopa, Durango, 1906, *Palmer 392* (U. S. Nat. Herb. no. *571417*).

This is also related to the potato, but is still smaller, the corolla only about 12 mm. broad. The leaf-segments are few, 5 or 7, the intermittent smaller ones usually found in the potato and its relatives are practically lacking in this species. No specimens except the type have been seen.

4. **Solanum Wightianum** Rydberg sp. nov.

A perennial, with subterranean stolons and tubers; stem herbaceous, about 3 dm. high, striate, pilose with flat, somewhat kinked hairs; leaves on the seedlings or young shoots simple, the petioles 1–1.5 cm. long, the blade ovate, 2–3 cm. long; leaves of the better developed plant pinnately 3–5-foliolate, 1–1.5 dm. long; rachis wing-margined; leaf-segments distinctly petioluled, long-pilose on both sides, the blade ovate or oval, acute or acutish, that of the terminal segment 4–6 cm. long, that of the upper pair 2–4 cm. long and that of the lower pair if present, 5–15 mm. long; peduncle 4–5 cm. long; raceme about 5-flowered; pedicels 2–3 cm. long, articulate above the middle; calyx white-pilose, 5 mm. long, the lobes lance-deltoid, acute, slightly longer than the tube; corolla pentagonal, 14–15 mm. wide, white, puberulent without; anthers oblong, 4 mm. long, cordate at the base.

Type grown from tubers, collected by F. S. Lozano near Acambaro, Guanajuato, in 1904 (Gray Herbarium).

This species is named in the honor of W. T. Wight of Washington, who has done a good deal of work on the tuber-bearing Solanums, and has indicated on the type sheet that he regarded it as belonging to an undescribed species.

5. SOLANUM STOLONIFERUM Schlecht. & Bouché, Verh. Beförd. Gartenb. Preussen **9**: 317. *pl. 2.* 1833

Bitter seems not to have seen any native specimen except those collected by Schiede and Deppe. There is, however, no uncertainty as to its identity as the original publication contains a good illustration. Furthermore, there is a cultivated specimen in the Columbia University herbarium from the Botanic Garden at Brasel. A specimen collected on ballast, near Communipaw Ferry, New Jersey, by Addison Brown might belong to it. The only Mexican specimens I have seen are the following:

QUERÉTARO: Near Cadueyta, *Rose, Painter & Rose 9841.*

6. **Solanum polytrichon** Rydberg sp. nov.

A perennial, with subterranean stolons and tubers; stem herbaceous, 1–3 dm. high, densely hairy with long white crisp many-celled hairs; leaves 6–15 cm. long, odd-pinnatifid; rachis narrowly winged, densely hirsute; principal leaf-segments 5–9, sessile, ovate, or the terminal one broadly oval, 1–4 cm. long, obtuse or acute at the apex, rounded at the base, densely white-hairy on both sides, the lowest one or two pairs much reduced; intermittent smaller segments usually present, 1–4 mm. long, rounded; pseudo-stipular leaves lunate, 3–5 mm. long; peduncles 1–4 cm. long, hirsute; inflorescence branched, 5–8-flowered; pedicels 1–2 cm. long, articulate above the middle; calyx sparingly hirsute, the tube and the lobes each about 2.5 mm. long, the latter lanceolate, acute; corolla white, about 1.5 cm. broad, puberulent, the lobes broadly triangular; anthers 4 mm. long, cordate at each end; young fruit globose.

Type collected in the vicinity of San Luis Potosi, 1878, *Parry & Palmer 632* (U. S. Nat. Herb. *42677*).

This species is most closely related to *S. Fendleri*, but differs in the dense pubescence with long white hairs.

7. SOLANUM FENDLERI A. Gray, Am. Journ. Sci. II. **22**: 285. 1856

S. tuberosum boreale A. Gray, Syn. Fl. **2**[1]: 227. 1878.

S. boreale Bitter, Repert. **11**: 459. 1912.

The original specimens of *S. Fendleri* had deep violet corollas but the color varies considerably and white-flowered specimens are as common as those with purple or bluish shades. Bitter thought that the white-flowered specimens represented a distinct species and adopted for this Dr. Gray's varietal name, *boreale*. Though the white-flowered specimens often are less hairy and the

leaves of a paler color, these characters are by no means constant, and all kinds of grades exist. Apparently the first specimens collected of the white-flowered form were those by Bigelow at Puerto de Paysano, *Mexican Boundary Survey 1008*, in part. These were referred by Dr. Torrey* to *S. Jamesii*, probably because they had white flowers. The blue- or purple-flowered specimens from the Copper Mines were named by him *S. Fendleri*.

The following specimens belong here. Those numbers with white flowers are so indicated.

NEW MEXICO: *Mex. Bound. Surv. 1009; 1008*, in part (white); *Greene* (in 1880); *Rusby 313* (white); *Wooton* (in 1894, 1895 and 1899); Metcalfe *838*.

ARIZONA: *Wilcox* (in 1892); *Goodding 746, 264*, (white); *Griffiths & Thornber 102* (white); *Blumer 1432* (white); *1566, 1579; Mearns 1534*.

SONORA: *Mearns 1599, 1635, 1752*.

CHIHUAHUA: *Pringle 667* (white); *E. W. Nelson 6166; Townsend & Barber 173; Gregg 420*.

COAHUILA: *Palmer 305*.

NUEVO LEON: *Palmer 937, 938*, in part (white).

DURANGO: *Palmer 484* (white).

8. SOLANUM DEMISSUM Lindl. Jour. Hort. Soc. **3**: 69, 70. 1848

S. utile Klotzsch. All. Gart. Zeit. **17**: 315. 1849.

S. demissum Klotzschii Bitter, Repert. **11**: 454. 1912.—**12**: 454. 1913.

S. demissum resembles *S. Fendleri* in habit, and Mr. W. F. Wight of Washington has regarded the latter as a synonym of the former. From Lindley's figure on page 69 and Bitter's description of *S. utile*, the corolla is different. In *S. Fendleri* the corolla is pentagonal, but in *S. demissum* the intrapetalar membranes are developed into lobes, making the corolla almost 10-angled, a character which the species has in common with *S. verrucosum*. The characters by which Bitter tries to distinguish *S. utile* from *S. demissum* seem to me trifling, and perhaps due to cultivation. Bitter evidently knew *S. utile* only in the cultivated form. A cultivated specimen of *S. utile* is in the herbarium of Columbia University. This agrees with Lindley's figure of *S. demissum*.

* Bot. Mex. Bound. Surv. 151. 1859.

MEXICO (Federal District): *Bourgeau 346.*
MEXICO (State): *Kuntze 23611, 23774.*
VERA CRUZ: *Rose & Hay 5701, 6024, 6240.*
HIDALGO: *Rose & Hough 4487.*
SAN LUIS POTOSI: *Palmer 83½, Schaffner 407–693.*
ZACATECAS: *Pringle 3499.*

9. SOLANUM VERRUCOSUM Schlecht. Ind. Sem. Hort. Hal. **1839**: 10. 1839.—Hort. Hal. 13,: *pl. 2.* 1841

S. squamulosum Mart. & Gal. Bull. Acad. Brus. **12**: 140. 1845.
S. verrucosum iopetalum Bitter, Repert. **11**: 455. 1912.

In the United States National Herbarium there is a specimen which bears the following label:

"1132. Solanum stoloniferum Schlecht. et Bouche.
(*Solanum squamulosum* Martens et Galeotti). Mexico. C. Ehrenberg."

This specimen had come from the Botanical Museum at Berlin. The specimen does not agree with the description of *S. stoloniferum*, but well with that of *S. verrucosum*. Schlechtendahl,* who had before him Ehrenberg's specimens of both species, stated that the flowers of *S. stoloniferum* had white flowers and *S. verrucosum* bluish-purple. In the specimen mentioned in the National Herbarium the flowers are purple and the leaves bearing the strong hairs of the latter species. Furthermore, *S. squamulosum* is supposed to be a synonym of *S. verrucosum*, not of *S. stoloniferum*. Evidently there must have been some error committed in labelling the specimen. Perhaps it represents part of the original collection of *S. verrucosum* made at Mineral del Monte.

The species was originally published in the Index Seminum of 1839, though the description is very meager. In that publication no reference was made to Ehrenberg's specimen and the species must therefore be regarded as based on the cultivated specimens, which according to Schlechtendahl would be illustrated together with another species with acute fruit. These illustrations were published two years later, when the author stated that the seeds were collected by Ehrenberg at Mineral del Monte. Bitter regarded one of Ehrenberg's herbarium specimens as the type, and drew his description from that. Schlechtendahl's illustration in

* Linnaea **19**: 274. 1847.

Hortus Halensis, drawn from the cultivated material, resembles so closely our duplicate of the type of Bitter's var. *iopetalum*, that I regard the latter as typical *S. verrucosum*. The Ehrenberg specimen, however, does not differ, as far as I can judge, very much from them.

SAN LUIS POTOSI: *Parry & Palmer 633* (in part, as represented in U. S. Nat. Herb.*).

HIDALGO: *Rose & Rose 11490; Pringle 8954; Rose & Hay 5579; Ehrenberg 1132.*

MEXICO (State): *Rose & Hay 6259.*

VERA CRUZ: *F. Mueller 3041, 1673.*

OAXACA: *Galeotti 1190, 1225 P.*

COSTA RICA: Volcan Irazu, *Popence 1015.*

10. **Solanum Ervendbergii** Rydberg sp. nov.

A perennial with subterranean rootstocks and tubers; stem low, less than 2 dm. high, striate, puberulent; leaves 6–10 cm. long, the rachis scarcely margined, puberulent; leaf-segments mostly 7, distinctly petioluled, the blades lanceolate, somewhat oblique at the base, 2–3 cm. long, acute or somewhat acuminate, puberulent on both sides; intermittent segments not present; peduncle 6–7 cm. long, slender, puberulent; racemes 4–7-flowered; calyx strigose, 3–3.5 mm. long, the lobes lanceolate, longer than the tube, acute; corolla white, pentagonal, about 1 cm. wide, the lobes broader than long.

Type collected at Wartenberg, near Tantoyuca, Vera Cruz, in 1858, *Ervendberg 175* (Gray Herbarium).

The type was first determined as *S. Jamesii* Torr.?, then changed to *S. appendiculatum* Dunal? Somebody has later determined it as *S. stoloniferum*, which name again has been changed by Wight to *Solanum Jamesii* Torrey. It has nothing to do with *S. appendiculatum* which is a climbing vine with subbasal articulation on the pedicels. In habit it resembles *S. Jamesii* but the leaflets are stalked and the corolla pentagonal and not star-shaped. *S. stoloniferum* has ovate leaf-segments and larger flowers. It is probably most closely related to *S. verrucosum*, but the plant is more slender, with much smaller corolla, and the leaves are puberulent not hirsute and without intermittent segments.

* On this specimen in the U. S. Nat. Herb., the number has been changed from 753 to 633, which change might have been unwarranted. Number 633 in the Columbia University herbarium belongs to *S. cardiophyllum*.

11. **Solanum agrimonifolium** Rydberg sp. nov.

A perennial, probably stoloniferous and with tubers; stem at least 5 dm. high, angled, or even slightly winged, glabrous; leaves odd-pinnatifid, 1–2 dm. long; rachis narrowly margined, glabrous; principal leaf-segments 9–15, narrowly lanceolate, 3–8 cm. long, 1–2 cm. wide, long-acuminate, glabrous or with a few scattered hairs, the lateral ones sessile, very oblique at the base, cuneate on the upper margin, semicordate on the lower; intermittent smaller segments numerous, often two pairs in each interval, elliptic, 2–8 mm. long; pseudo-stipular leaves obliquely ovate, 5–10 mm. long; cymes 8–10-flowered; peduncle 7–10 cm. long, glabrous; pedicels 2–4 cm. long, articulate above the middle; calyx glabrous, turbinate, the tube 3 mm. long, the lobes lanceolate, 4–5 mm. long, acuminate, corolla 15–18 mm. broad; lobes broadly triangular, short-acuminate, puberulent without; anthers oblong, 4 mm. long, cordate at each end; fruit unknown.

Type collected at Cerro del Boqueron, Chiapas, September, 1913, *C. A. Purpus 6977* (U. S. Nat. Herb. *567248*).

NEW YORK BOTANICAL GARDEN

[To be continued in May Bulletin.]

INDEX TO AMERICAN BOTANICAL LITERATURE

1923

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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